New Claim 54. The barrier coating material of claim 3, further comprising at least one element selected from the group consisting of tungsten, ruthenium, and mixtures of tungsten and ruthenium.

New Claim 55. The barrier coating material of claim 9, further comprising about 1 atom % to about 35 atom % of at least one element selected from the group consisting of nickel, cobalt, iron, and combinations thereof.

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New Claim 56. The barrier coating material of claim 9, further comprising at least one element selected from the group consisting of rhenium, ruthenium, and mixtures of rhenium and ruthenium.

New Claim 57. The barrier coating material of claim 13, further comprising at least one element selected from the group consisting of tungsten, rhenium, and mixtures of tungsten and rhenium.

REMARKS

Restriction Requirement

Applicant has reviewed the Examiner's recent response to the previous traversal of the restriction requirement. There is still some question as to the rationale regarding the restriction, and Applicant continues to maintain that all of the claims are part of one inventive concept. However, a review of the substantive issues now takes priority over the restriction issue. Applicant does appreciate the Examiner's offer to revisit the restriction issue upon allowance of other claims in this case.

Claim Objections

Applicant has reviewed the objection regarding claim 17, and is in agreement with the Examiner. The claim has been canceled.

Claim Rejections - 35 U.S.C. 112

Applicant has also reviewed the rejection of claims 16, 17 and 52 under this section, and is again in agreement with the Examiner. In response, claim 16 (like claim 17) has been canceled. Claim 52 has been amended, in part, to remove the inadvertent recitation of ruthenium from component (d), since the element had already been recited as part of component (b). The undersigned appreciates the Examiner pointing out these inconsistencies, since the "sorting out" of multi-element claims like these during amendments can become a bit confusing.

Claim Rejections - 35 USC 102

Claims 1, 2, 4, 10, 11, 18, 19, 48, 50 and 51 have been rejected under U.S.C. 102(b). The reference applied in the rejection is Schutz et al ("Schutz"), U.S. Patent 4,915,733. It is the Examiner's opinion that Schutz teaches metal composite powders having compositions which generally fall within the scope of the rejected claims.

Schutz describes metal composite powders, along with a process for their preparation. The powders include more than 70% by weight of at least one of molybdenum, rhenium, and tungsten. One or more binder metals are also included, such as iron, cobalt, nickel, chromium, and rhenium (col. 1, lines 57-68). The metal powders of Schutz are actually in the form of powder agglomerates, having an oxygen content of less than 1.5%. Some of the compositions noted by the Examiner appear to fall within the ranges of the pending claims.

However, Schutz fails to disclose a "barrier coating", as in the present invention. Instead, the patent is restricted to powders. In particular, the patent is directed to "agglomerates of individual particles" (col. 1, as noted above; claim 1). Applicant submits that these particles do not anticipate the coating layer of the present invention.

In order to elucidate the concept of "coating layer", claims 1, 48, and 50-51 have been amended. The term "material" has been deleted and "diffusion" added, so that emphasis is now placed on a "diffusion barrier coating". Nothing in Schutz describes or even suggests a coating of any type. Instead, the reference appears to describe materials that are employed only in powder-related applications. Applicant thus requests that the rejections of the amended claims, as well as claims dependent therefrom, be removed.

Claim 50 has also been rejected under U.S.C. 102(b), based on a patent issued to Fischbein et al ("Fischbein"), U.S. 3,829,969. Fischbein describes protective metal layers made from certain alloy compositions. One component in the alloy is a metal such as iridium, platinum, palladium, rhenium, and the like. A second component is a metal such as chromium, manganese, niobium, tungsten, and vanadium. As the Examiner notes, a composition listed in the table of columns 9-10 contains 71 atom % chromium and 29 atom % ruthenium.

However, Fischbein fails to disclose a "barrier coating". The patent also never describes the use of a diffusion barrier layer between a substrate and an overlying layer, as in the present invention. Instead, the invention of Fischbein appears to be restricted to coatings which exhibit wear resistance and corrosion resistance (col. 2, lines 12-14). The alloy structures of the patent are designed to be sharpened and used as razor blades (e.g., col. 7, lines 28-32). These objectives have nothing to do with those of the present

invention. As noted above, claim 50 has been amended to recite the presence of a diffusion barrier coating, and should fall outside the scope of Fischbein.

Applicant also emphasizes that the Fischbein patent is describing what appears to be an exceptionally thin coating. The patent (col. 3, lines 16-21) restricts thickness to 600 angstroms, while many of the examples (e.g., the table across columns 9 and 10) show samples with thicknesses in the range of 200 angstroms to 350 angstroms. This thickness is understandable, in view of the fact that the patent is directed specifically to very fine cutting edges for shaving instruments - not to any type of barrier structure.

Claims 5, 48, and 50-52 have been rejected under 35 U.S.C. 102(b), as being anticipated by Czech et al, U.S. Patent 5,273,712 ("Czech '712"). This patent was discussed at length in the previous Response, and describes a protective coating which contains rhenium, chromium, and optionally, other metals such as nickel, cobalt, and tungsten (col. 1, line 59-col. 2, line 19).

Czech '712 describes relatively low levels of tungsten. Czech '712 also fails to disclose a composition in the form of a barrier layer, as in the present invention. The patent is directed to specific compositions which provide corrosion and oxidation properties (col. 1, lines 54-58; col. 2, lines 19-24).

Applicant maintains that Czech '712 does not disclose the invention of claim 5. However, to reduce issues in this prosecution, the claim has been amended. The claim now recites the presence of a barrier layer, and a lower level for tungsten (about 10 atom %) in that layer. Support for the level of tungsten can be found, for example, in claim 6, as originally filed.

Claims 48, 51 and 52 have also been amended, and some of those changes are related to Czech '712. In claims 48 and 51, the tungsten

level has also been increased to about 10%, although Applicant again emphasizes that the "diffusion barrier coating" distinguishes over this patent, even without the compositional change. Moreover, the level of rhenium in claims 51 and 52 has been increased slightly, to further distinguish over Czech '712. The change is based on the description in paragraph 19 of the specification.

Claim 50 has also been amended to emphasize the presence of a diffusion barrier layer. However, the claim is not anticipated by Czech '712 for another important reason. The claim recites a composition which "consists essentially" of chromium and at least one of rhenium, tungsten, and ruthenium. In contrast, Czech '712 requires the presence of at least one of nickel, iron, and cobalt in its coating. (See, e.g., column 1, line 63 to column 2, line 3). The presence of these elements is readily understood, since Czech '712 is directed to conventional protective coatings, as described above. The Examiner characterizes the inclusion of a metal like nickel as being merely a binder, and not altering the general composition.

Applicant must emphatically disagree, based in part on discussions with the inventors. In some instances, the presence of nickel can significantly affect the microstructural stability and melting temperature of the barrier coating of claim 50. In certain environments in which the substrate is exposed to high temperatures for long periods of time, the presence of nickel may promote greater diffusion across the barrier layer. This is not to say that nickel is not a desired element in other embodiments. In the present embodiment, however, nickel is excluded by the transitional phrase, and this claim cannot be anticipated by Czech '712.

Claims 21-26, 28-29, 37 and 39 are rejected under U.S.C. 102(b), as being anticipated by Jackson, U.S. Patent 4,980,244. Jackson has been discussed in earlier prosecution, in regard to other claims. In brief, the patent describes a composition consisting essentially of chromium, ruthenium,

and aluminum. The components are present in proportions set forth within the bounds of curve A, as shown in the triaxial plot of FIG. 5 (see claim 1; and col. 2, lines 60-64).

Certainly, Jackson includes some features which are similar to those of the present invention. For example, the patent describes the use of protective coatings for turbine engine components. As discussed in the first Response, Jackson also describes some ruthenium-containing compositions which overlap some of the compositions of the present invention.

However, Jackson fails to describe the structure of claim 21. While the patent describes the presence of a metal-based substrate, it fails to describe the presence of a diffusion barrier layer between the substrate and an overlying, oxidation-resistant coating. Instead, the ruthenium-containing layer of Jackson represents the protective coating itself - not a barrier layer between a metal substrate and another protective layer, as in the present invention.

Moreover, Jackson fails to describe the presence of a diffusion barrier layer on a superalloy substrate, as recited in claim 26. Instead, the patent is specifically directed to higher temperature substrates, e.g., refractory substrates. (See column 1, lines 46-58; column 2, lines 15-29; and column 4, lines 19-34).

Applicant also submits that claims 28 and 29 are not anticipated by Jackson. The Examiner's statement regarding the patent's disclosure of an aluminum-rich coating over a diffusion barrier layer is not completely understood. Clarification is respectfully requested. Moreover, Applicant fails to recognize a section of Jackson which relates to aluminide or overlay coatings deposited over the diffusion barrier layer.

Furthermore, the structure recited in pending claim 37 does not appear to be found in the Jackson patent. The Examiner refers to the

discussion of an aluminum oxide layer in the patent (col. 8). However, that layer appears to be formed over what the Examiner would refer to as the "protective coating" (see line 3, page 5 of the current Office Action). Under that assumption, Jackson appears to be "missing" one layer of the claim, which recites 4 elements, in sequence: substrate, diffusion barrier layer, oxidation-resistant coating, and ceramic coating. Thus, Applicant requests that the anticipation rejection be withdrawn.

Claims 48, 50 and 51 have been rejected under 35 U.S.C. 102(b), as being anticipated by Kapoor (SIR H1146). Kapoor describes tungsten-based heavy alloys. The alloys include about 80-100 wt. % tungsten and 0-20 wt. % of at least one alloying element like molybdenum, hafnium, rhenium, chromium, and the like (col. 2, lines 15-23). Such an alloy can be further blended with copper, iron, nickel, cobalt, or tantalum (claim 3). The Examiner is correct in that there is some overlap with the presently-claimed invention, e.g., at 53 atom % tungsten and 46 atom % chromium.

However, similarity to the present invention ends at that point. Kapoor has nothing to do with alloy coatings or barrier layers. Instead, Kapoor is directed to processes (e.g., plasma rapid solidification) for making powders into spherical objects (col. 1, lines 12-15 and 61-65). These objects are presumably in the form of projectiles of some sort, e.g., kinetic energy penetration projectiles (col. 3, lines 5-12).

Claims 48, 50 and 51 include changes made herein, which serve to definitively place their subject matter outside the boundaries of Kapoor. In each claim, "barrier coating material" has been changed to "diffusion barrier coating". Since Kapoor never describes or even suggests a barrier coating, this reference should no longer be deemed to anticipate these claims.

Claim 49 has been rejected under 35 U.S.C. 102(b), as being anticipated by Prasad, U.S. Patent 4,459,263. Prasad describes a dental alloy,

containing, primarily, cobalt, chromium, ruthenium, and aluminum. As described in the paragraph bridging columns 6 and 7, the compositions generally can include, in weight percent: 40-60% cobalt, 20-30% chromium, 5-15% ruthenium, and 1-4% aluminum. According to the Examiner, this range overlaps with that of claim 49. An example is provided in the Office Action, in which a composition is converted to the following atomic percentages: 49.7 atom % cobalt, 8.5 atom % aluminum, 8.5 atom % ruthenium, and 33.1 atom % chromium.

Prasad has little to do with the present invention. The patent is restricted to dental alloys suitable for porcelain-fused-to metal repairs (col. 1, lines 7-13; claim 1). Moreover, the compositions of Prasad specifically exclude the presence of nickel, as described in the paragraph bridging columns 1 and 2. In contrast, the open-ended language of pending claim 49 allows for nickel, which is a desirable component in some embodiments of this invention. Prasad has nothing to do with a diffusion barrier coating.

While the differences between claim 49 and Prasad appear to be evident, a small amendment has been made to reduce the issues in prosecution. Thus, the lower level of ruthenium has been changed from 5 atom % to 10 atom %. Support for the new limitation in the claim can be found in various sections of the specification, e.g., page 6, paragraph 20. As the Examiner can recognize, the highest level of ruthenium described in Prasad is 8.5 atom %. Applicant thus maintains that claim 49 is now patentable.

Claim Rejections - 35 USC 103

Claims 35 and 36 have been rejected under 35 U.S.C. 103(a), as being unpatentable over the Jackson reference, U.S. Patent 4,980,244. Jackson has been discussed above, and in previous prosecution. These claims relate to the thickness of the barrier layer of claim 21. It appears to be the Examiner's position that selection of a particular thickness for protection

against environmental attack would be obvious, absent a showing of unexpected results.

Certainly, claims 35-36 are directed to barrier layer thickness. However, the claims must be interpreted in light of the claims from which they depend, e.g., claim 21 for the present invention. As noted above, Jackson fails to describe or suggest the structure of that claim.

Jackson has nothing to do with the design of a barrier layer which prevents diffusion of aluminum from an overlayer into the substrate. Instead, the patent is directed specifically to an overlayer itself, i.e., a protective coating for refractory-type substrates used in very high temperature applications. While Jackson does allude to the possibility of a barrier coating (col. 4, lines 51-55), there is no suggestion as to its composition.

Thus, Applicant submits that Jackson differs greatly from the present invention, in addition to the admitted absence of coating thickness. Without any suggestion of the foundational structure of claim 21, it would appear that no one would read the Jackson patent and envision the barrier layer thickness ranges for such a structure. It is therefore requested that the rejection of these claims be withdrawn.

Claim 38 has been rejected under 35 U.S.C. 103(a), as being unpatentable over the Jackson patent, in view of Cybulsky et al, U.S. Patent 6,168,875 ("Cybulsky"). Cybulsky describes a coating system for blade and vane components, which includes an iridium-niobium (Ir-Nb) bond coat. The bond coat is used to firmly bond an overlying thermal barrier coating (TBC) to the substrate or other underlying layers. The TBC can be a conventional, stabilized-zirconium type (claim 3). It is the Examiner's position that applying the zirconia-type TBC of Cybulsky to the turbine component described in Jackson would have been obvious, in view of the desire to protect the component from harsh environments.

Applicant certainly agrees that Cybulsky describes the use of a conventional TBC. However, the patent is missing critical features of the present invention. For example, Cybulsky fails to suggest the use of a diffusion barrier layer similar in any way to the present invention. Instead, the patent is directed to coating structures which appear to include the Ir-Nb bond coat under the TBC but over a NiCoCrAlY-type protective coating. Such a layer would probably provide relatively poor oxidation resistance for the present invention. Moreover, while diffusion barrier layer 16 (FIG. 1) does lie between the protective coating 18 and the substrate 12, the barrier is based on tantalum, tantalum-nickel, or rhenium (Col. 1, lines 54-59).

Applicant does not dispute the fact that the zirconia-based TBC's described in Cybulsky are conventional. However, Cybulsky fails to "supply" the other critical features of the present invention which are missing from the Jackson patent, i.e., the specific type of barrier coating recited in claim 21. Without any suggestion of such a barrier coating, claim 38 appears to be nonobvious in view of these two references.

Claims 21-28, 35-37 and 39 have been rejected under 35 U.S.C. 103(a), as being unpatentable over Czech et al, U.S. Patent 5,273,712 ("Czech '712"), in view of Cybulsky et al. Both of these patents have been described in some detail previously. The Examiner contends that it would have been obvious to apply the zirconia thermal barrier layer of Cybulsky to the turbine component of Czech '712, to provide additional environmental protection.

Some of the compositional differences between Czech '712 and the present invention have been noted previously, in regard to other claims being examined. However, another important consideration is that Czech '712 fails to describe or suggest the presence of a barrier layer, i.e., a barrier layer which prevents aluminum migration from an overlying coating into an underlying substrate (e.g., see page 4, paragraph 12 of the present

specification). Instead, Czech '712 is simply describing a typical MCrAlY-type coating which also includes rhenium (col. 1, line 59 to col. 2 line 3; col. 2, lines 19-26).

A further review of the Czech '712 patent reveals conventional objectives, such as corrosion- and oxidation-resistance at elevated temperatures. However, the patent is silent as to the objectives of the present invention, e.g., prevention of aluminum migration into the substrate, and prevention of substrate element migration into a protective coating. (See paragraph 13 of the specification). The absence of these teachings is understandable, since Czech '712 shows no recognition of the problems which prompted the present invention. Instead, the patent appears to be primarily directed to using rhenium as an economic alternative to platinum group elements in extending the service life of turbine components (col. 2, lines 19-26).

Applicant agrees with the Examiner that Czech '712 fails to describe the ceramic topcoat ("further overcoat") employed in some embodiments of the present invention. However, it is readily evident that the reference fails to even suggest the basic structure of claim 21. The second applied reference, Cybulsky, certainly provides the description of the topcoat (e.g., a TBC), but also fails to describe a coating structure similar to that of claim 21. Thus, Applicant questions the "combinability" of these two references in a way which makes the relevant claims obvious.

For these same reasons, the modified barrier layer recited in claims 24 and 25 (e.g., with additions of nickel/cobalt/iron or aluminum) appears to be nonobvious, in view of the coating structure in which the barrier layer is incorporated. Furthermore, the substrate embodiments covered in claims 26-27, protected by a coating system as recited in claim 21, are also never suggested by Czech '712 or Cybulsky. Moreover, the use of an aluminum-rich coating over the claimed barrier layer (claim 28), which

demonstrates the utility of the barrier in preventing aluminum migration, is neither suggested nor disclosed by the references.

The Examiner refers to the coating thicknesses for the barrier layer, recited in claims 35-36. The referenced case law regarding the obviousness of the thickness of an object may be correct, in the abstract. However, such a pronouncement in no way detracts from the patentability of these particular claims. If the two cited references fail to suggest a barrier layer in a coating structure like that of claim 21, they cannot be used to make the thickness of such a layer obvious. Applicant thus requests reconsideration of this rejection.

Claims 21-27 and 39 have been rejected under 35 U.S.C. 103(a), as being unpatentable over Czech et al, U.S. Patent 5,154,885 ("Czech '885"), in view of Leverant et al, U.S. Patent 6,143,141 ("Leverant"). The Examiner contends that Czech '885 teaches a corrosion-resistant protective coating, presumably similar to the present invention, but does not describe an additional layer of metallic material, or a ceramic thermal barrier. Leverant is then described as including the additional metal (aluminide) layer. The Examiner then appears to conclude that it would have been obvious to apply Leverant's aluminide layer to a turbine component. (This is Applicant's interpretation of the last sentence of the first full paragraph on page 7 of the Office Action, but the Examiner may want to clarify the sentence).

Czech '885 describes a protective coating for metal components. The coating primarily contains rhenium and chromium. It can optionally contain aluminum, rare earth elements, and small amounts of other elements like hafnium, tungsten, and manganese. The coating is applied to nickel- or cobalt-based superalloys (col. 1, line 52 to col. 2, line 11).

However, Czech '885 fails to describe the key features of claim 21, e.g., a diffusion barrier layer between the substrate and an oxidation-

resistant coating. Czech '885 is merely concerned with the oxidation-resistant coating itself, and improving the performance of such coatings. Czech '885 has nothing to do with the concept of preventing aluminum migration, as covered in pending claims 28-31, or the use of a barrier layer to accomplish that goal.

It appears that the Examiner is equating the conventional, oxidation-resistant coating of Czech '885 with Applicant's clamed barrier layer. This is a difficult comparison, since the barrier layer requires, for utility, a separate oxidation-resistant coating over it. Even if the layers could be equated, Czech '885's layer is quite different from Applicant's barrier material. While there may be a small amount of overlap in the comparative compositions, it can be seen that 1-20 weight percent rhenium is a much lower level than in many of Applicant's preferred embodiments. The fact that Czech '885's coating can conceivably contain only 1 weight percent rhenium is a good demonstration that the patent never contemplated the layer to be used as a barrier, as in the present invention.

Leverant describes a method of forming a diffusion barrier layer for overlay coatings. The method involves forming a first film of rhenium atoms on the surface of a superalloy substrate (col. 2, lines 19-35). The first film is then treated, e.g., with heat, to diffuse some of the rhenium into the substrate surface (col. 3, lines 16-37). Nickel-rhenium alloys are the preferred materials for the barrier layer. An overlay coating (like MCrAlY) can then be applied over the barrier layer (col. 5, lines 1-7).

Leverant fails to suggest the chromium-rhenium barrier layer materials of the present invention. Moreover, it appears that Leverant is describing a very thin layer of rhenium (e.g., submicron) as the barrier layer. Such a layer may sometimes be useful. However, as the temperature increases, e.g., to turbine engine firing temperatures, the interdiffusion between the overlayer and the substrate may become more severe. In that

instance, a very thin layer of rhenium may be insufficient for reducing interdiffusion. (This interdiffusion can lead to reduced coating life as aluminum leaves the outer regions of the protective coating, as described in paragraphs 5-7 of the present specification).

One might then propose that thicker layers of rhenium be used in the barrier layer. However, relatively thick rhenium layers can result in a substantial mismatch in the coefficient of thermal expansion (CTE) between the barrier and the substrate. This CTE difference can cause the overlying layer to spall during thermal cycling. It was, in part, this situation which prompted conception of the particular barrier layer composition of the present invention.

Leverant never shows any recognition of these problems with rhenium-dominant barrier layers, nor does the patent suggest any solution to these problems. As shown above, Czech '885 also fails to suggest such problems, and does not even hint at the notion of using a barrier layer. For these reasons, it seems apparent that the combination of Leverant and Czech '885 cannot be made in this instance. In regard to the Examiner's conclusion, Applicant must emphasize that much more than an "aluminide layer" is missing from Czech '885, while Leverant is missing any suggestion of the particular barrier coating composition of this invention. Clearly, the two patents have the same, broad, overall objective of the present inventors: protection of metal components from a harsh, high-temperature environment. However, the means to accomplish that objective is very different.

Claims 38 and 40 have been rejected under 35 U.S.C. 103(a), as being unpatentable over Czech et al("Czech '885"), Leverant, and Cybulsky (also discussed above). These claims are directed to the presence of a top layer, i.e., a zirconia-based TBC, over the coating structure described previously, which is itself disposed on a metal substrate. It appears that the additional patent, Cybulsky, is being used to show that it would be obvious to

apply the TBC's of Cybulsky over the structure which would result from the combined teachings of Czech '885 and Leverant.

Again, Applicant agrees that the use of TBC's over many of these protective coating systems is generally known in the art. However, Cybulsky adds nothing else to the rejection, since it is directed to something entirely different: iridium-niobium bond coats under a TBC and over a conventional, MCrAlY-type coating. As described above, the "core" of the invention is not suggested by any attempted combination of Czech '885 and Leverant, and Cybulsky adds nothing to that core, other than the TBC. Claim 38 depends on that core recitation of claim 21, while claim 40 is analogous to claim 21, albeit a bit more detailed, and supplemented by the TBC. Applicant thus requests that the Examiner reconsider this rejection.

Allowable Subject Matter

Applicant acknowledges the allowable subject matter noted on page 8 of the Office Action. It is also believed that independent claims like claim 1 and claim 48 will ultimately be allowed. Therefore, the allowable, dependent claims have not been rewritten at this time.

Several other minor changes have been made to the claims, for the sake of consistency. For example, the chromium level in claim 6 has been reduced to 90 atom %, which allows for the minimum level of tungsten in that instance, i.e., 10 atom %. (In other embodiments, the chromium level remains at 95 atom %). No new matter has been added.

A number of dependent claims have been added, and they are directed to some of the specific embodiments of the present invention. Claims 53-57 are directed to various additional components to claims 3, 9 and 13. In general, the additional components are selected from the elements nickel, cobalt or iron, and/or the elements tungsten, rhenium, or ruthenium, as set

forth in specific claims. None of the additional claims involve new matter, as the sets of elements were recited in the original claims, and described in various sections of the specification. Since these new claims are dependent on allowable subject matter, they too should be entered here and designated as allowable.

Note Regarding Examiner's "Response to Arguments"

Applicant acknowledges the acceptance of the Rule 131 affidavit, which was directed to the Spitsberg '524 reference in the first Office Action. However, Applicant continues to maintain that the claims at issue in the relevant rejections were in fact patentable over that cited reference, absent the affidavit. Nevertheless, the affidavit did serve to advance prosecution.

Applicant also reviewed the comments made by the Examiner on page 8 of the current Office Action. The comments related to conversions between weight percent and atomic percent. The Examiner notes that the conversions do not take into consideration other elements that may be present in the barrier layer. Moreover, the Examiner maintains that the conversions show overlap with the ranges in Applicant's claims.

Applicant appreciates the Examiner's thoughts on this topic, but is unsure as to some of the points being made. While it may be true that the conversions do not always account for other materials that may be present, they do provide a benchmark for distinguishing over the cited art. As a general example, if a claim under examination requires a minimum level of 10 atom % tungsten in a given embodiment, a reference which includes a maximum tungsten level of about 5 atom % cannot anticipate the claim. This holds true, regardless of any other components that are found in the reference, and regardless of the ranges for those components. The undersigned would be happy to further discuss this issue with the Examiner.

Applicant submits that the pending claims are now all in allowable form, as are the new claims. After the Examiner has reviewed this Response, an interview may be very helpful in resolving any remaining issues.

Respectfully submitted,

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"Marked-up" Version of Amended Claims,
Pursuant to 37 CFR 1.121c(1)(ii)

1. (twice amended) A diffusion barrier coating [material], comprising:

(a) about 15 atom % to about 95 atom % chromium; and

(b) about 15 atom % to about 60 atom % rhenium.

5. (twice amended) The diffusion barrier coating [material] of claim 48, wherein the level of tungsten is in the range of about [5] 10 atom % to about 20 atom %.

6. (amended) The diffusion barrier coating [material] of claim 5, wherein the level of tungsten is in the range of about 10 atom % to about 15 atom %, and the level of chromium is in the range of about 15 atom % to about 90 atom %.

48. (amended) A diffusion barrier coating [material], comprising:

(a) about 15 atom % to about 95 atom % chromium; and

(b) about [5] 10 atom % to about 60 atom % tungsten.

49. (amended) A barrier coating material, comprising:

(a) about 15 atom % to about 95 atom % chromium;

(b) about [5] 10 atom % to about 60 atom % ruthenium; and

(c) about 1 atom % to about 15 atom % aluminum;

wherein, for the maximum level of chromium present, the sum of (a), (b), and (c) is no greater than 100%.

50. (amended) A diffusion barrier coating [material], consisting essentially of:

(a) about 15 atom % to about 95 atom % chromium;

and

(b) about 5 atom % to about 60 atom % of at least one element selected from the group consisting of rhenium, tungsten, ruthenium, and combinations thereof.

51. (amended) A diffusion barrier coating [material], consisting essentially of:

(a) about 15 atom % to about 95 atom % chromium;

(b) [about 5 atom % to about 60 atom % of] at least one element selected from the group consisting of rhenium, tungsten, ruthenium, and combinations thereof; wherein for each element which may be present:

the level of rhenium is from about 15 atom % to about 60 atom %;

the level of tungsten is from about 10 atom % to about 60 atom %; and

the level of ruthenium is from about 5 atom % to about 60 atom %; and

(c) about 1 atom % to about 35 atom % of at least one element selected from the group consisting of nickel, cobalt, iron, and combinations thereof,

wherein, for the maximum level of chromium present, the sum of (a), (b), and (c) is no greater than 100%.

52. (amended) A barrier coating material, consisting essentially of:

(a) about 15 atom % to about 95 atom % chromium;

(b) [about 5 atom % to about 60 atom % of] at least one element selected from the group consisting of rhenium, tungsten, ruthenium, and combinations thereof; wherein for each element which may be present:

the level of rhenium is from about 15 atom % to about 60 atom %;

the level of tungsten is from about 10 atom % to about 60 atom %; and

the level of ruthenium is from about 5 atom % to about 60 atom %;

(c) about 1 atom % to about 35 atom % of at least one element selected from the group consisting of nickel, cobalt, iron, and combinations thereof; and

(d) about 0.1 atom % to about 5 atom % of at least one element selected from the group consisting of zirconium, titanium, hafnium, silicon, boron, carbon, tantalum, [ruthenium,] molybdenum, and yttrium,

wherein, for the maximum level of chromium present, the sum of (a), (b), (c), and (d) is no greater than 100%.